

**§ 1065.248 Gas divider.**

(a) *Application.* You may use a gas divider to blend calibration gases.

(b) *Component requirements.* Use a gas divider that blends gases to the specifications of § 1065.750 and to the flow-weighted concentrations expected during testing. You may use critical-flow gas dividers, capillary-tube gas dividers, or thermal-mass-meter gas dividers. Note that your overall gas-divider system must meet the linearity verification in § 1065.307.

CO AND CO<sub>2</sub> MEASUREMENTS**§ 1065.250 Nondispersive infrared analyzer.**

(a) *Application.* Use a nondispersive infrared (NDIR) analyzer to measure CO and CO<sub>2</sub> concentrations in raw or diluted exhaust for either batch or continuous sampling.

(b) *Component requirements.* We recommend that you use an NDIR analyzer that meets the specifications in Table 1 of § 1065.205. Note that your NDIR-based system must meet the calibration and verifications in §§ 1065.350 and 1065.355 and it must also meet the linearity verification in § 1065.307. You may use an NDIR analyzer that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

[76 FR 57442, Sept. 15, 2011]

## HYDROCARBON MEASUREMENTS

**§ 1065.260 Flame-ionization detector.**

(a) *Application.* Use a flame-ionization detector (FID) analyzer to measure hydrocarbon concentrations in raw or diluted exhaust for either batch or continuous sampling. Determine hydrocarbon concentrations on a carbon number basis of one, C<sub>1</sub>. For measuring THC or THCE you must use a FID analyzer. For measuring CH<sub>4</sub> you must meet the requirements of paragraph (f) of this section. See subpart I of this part for special provisions that apply to measuring hydrocarbons when testing with oxygenated fuels.

(b) *Component requirements.* We recommend that you use a FID analyzer that meets the specifications in Table 1 of § 1065.205. Note that your FID-based system for measuring THC, THCE, or CH<sub>4</sub> must meet all the verifications for hydrocarbon measurement in subpart D of this part, and it must also meet the linearity verification in § 1065.307. You may use a FID analyzer that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

(c) *Heated FID analyzers.* For measuring THC or THCE from compression-ignition engines, two-stroke spark-ignition engines, and four-stroke spark-ignition engines below 19 kW, you must use heated FID analyzers that maintain all surfaces that are exposed to emissions at a temperature of (191 ± 11) °C.

(d) *FID fuel and burner air.* Use FID fuel and burner air that meet the specifications of § 1065.750. Do not allow the FID fuel and burner air to mix before entering the FID analyzer to ensure that the FID analyzer operates with a diffusion flame and not a premixed flame.

(e) *NMHC.* For demonstrating compliance with NMHC standards, you may either measure THC and CH<sub>4</sub> and determine NMHC as described in § 1065.660(b)(2) or (3), or you may measure THC and determine NMHC as described in § 1065.660(b)(1).

(f) *CH<sub>4</sub>.* For reporting CH<sub>4</sub> or for demonstrating compliance with CH<sub>4</sub> standards, you may use a FID analyzer with a nonmethane cutter as described in § 1065.265 or you may use a GC-FID as described in § 1065.267. Determine CH<sub>4</sub> as described in § 1065.660(c).

[76 FR 57442, Sept. 15, 2011]

**§ 1065.265 Nonmethane cutter.**

(a) *Application.* You may use a nonmethane cutter to measure CH<sub>4</sub> with a FID analyzer. A nonmethane cutter oxidizes all nonmethane hydrocarbons

to CO<sub>2</sub> and H<sub>2</sub>O. You may use a nonmethane cutter for raw or diluted exhaust for batch or continuous sampling.

(b) *System performance.* Determine nonmethane-cutter performance as described in §1065.365 and use the results to calculate CH<sub>4</sub> or NMHC emissions in §1065.660.

(c) *Configuration.* Configure the nonmethane cutter with a bypass line if it is needed for the verification described in §1065.365.

(d) *Optimization.* You may optimize a nonmethane cutter to maximize the penetration of CH<sub>4</sub> and the oxidation of all other hydrocarbons. You may humidify a sample and you may dilute a sample with purified air or oxygen (O<sub>2</sub>) upstream of the nonmethane cutter to optimize its performance. You must account for any sample humidification and dilution in emission calculations.

[70 FR 40516, July 13, 2005, as amended at 73 FR 37300, June 30, 2008; 76 FR 57442, Sept. 15, 2011]

**§ 1065.267 Gas chromatograph with a flame ionization detector.**

(a) *Application.* You may use a gas chromatograph with a flame ionization detector (GC-FID) to measure CH<sub>4</sub> concentrations of diluted exhaust for batch sampling. While you may also use a nonmethane cutter to measure CH<sub>4</sub>, as described in §1065.265, use a reference procedure based on a gas chromatograph for comparison with any proposed alternate measurement procedure under §1065.10.

(b) *Component requirements.* We recommend that you use a GC-FID that meets the specifications in Table 1 of §1065.205, and it must also meet the linearity verification in §1065.307.

[76 FR 57442, Sept. 15, 2011]

**NO<sub>x</sub> AND N<sub>2</sub>O MEASUREMENTS**

**§ 1065.270 Chemiluminescent detector.**

(a) *Application.* You may use a chemiluminescent detector (CLD) to measure NO<sub>x</sub> concentration in raw or diluted exhaust for batch or continuous sampling. We generally accept a CLD for NO<sub>x</sub> measurement, even though it measures only NO and NO<sub>2</sub>, when coupled with an NO<sub>2</sub>-to-NO converter, since conventional engines and

aftertreatment systems do not emit significant amounts of NO<sub>x</sub> species other than NO and NO<sub>2</sub>. Measure other NO<sub>x</sub> species if required by the standard-setting part. While you may also use other instruments to measure NO<sub>x</sub>, as described in §1065.272, use a reference procedure based on a chemiluminescent detector for comparison with any proposed alternate measurement procedure under §1065.10.

(b) *Component requirements.* We recommend that you use a CLD that meets the specifications in Table 1 of §1065.205. Note that your CLD-based system must meet the quench verification in §1065.370 and it must also meet the linearity verification in §1065.307. You may use a heated or unheated CLD, and you may use a CLD that operates at atmospheric pressure or under a vacuum. You may use a CLD that has compensation algorithms that are functions of other gaseous measurements and the engine's known or assumed fuel properties. The target value for any compensation algorithm is 0% (that is, no bias high and no bias low), regardless of the uncompensated signal's bias.

(c) *NO<sub>2</sub>-to-NO converter.* Place upstream of the CLD an internal or external NO<sub>2</sub>-to-NO converter that meets the verification in §1065.378. Configure the converter with a bypass line if it is needed to facilitate this verification.

(d) *Humidity effects.* You must maintain all CLD temperatures to prevent aqueous condensation. If you remove humidity from a sample upstream of a CLD, use one of the following configurations:

(1) Connect a CLD downstream of any dryer or chiller that is downstream of an NO<sub>2</sub>-to-NO converter that meets the verification in §1065.378.

(2) Connect a CLD downstream of any dryer or thermal chiller that meets the verification in §1065.376.

(e) *Response time.* You may use a heated CLD to improve CLD response time.

[70 FR 40516, July 13, 2005, as amended at 73 FR 37300, June 30, 2008; 76 FR 57442, Sept. 15, 2011]